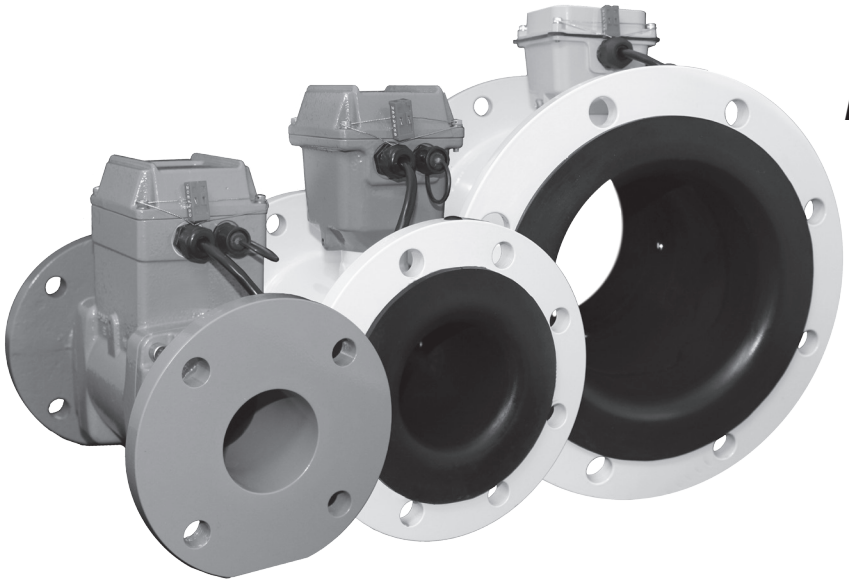
User's Guide



FMG-1000 SERIES

Municipal/Industrial Magmeter

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TABLE OF CONTENTS

General Information
General Information, Features ..... **Page 1**

Specifications
Specifications, Flow Range ..... **Page 3**

Installation and Grounding
Positioning the Meter, Straight Pipe Recommendations, Full Pipe Recommendations, Fittings, Calibration, Chemical Injection, Metal Pipe Installations, Plastic Pipe Installations..... **Page 4**

Straight Pipe Recommendations ..... **Page 5**

Full Pipe Recommendations ..... **Page 6**

Inputs/Outputs and Operation
Power, Pulse Output, High Frequency, K-Factor, Display Reading ..... **Page 7**

Connections Diagrams
FMG1000-MAW, FMG-1000-DL..... **Page 8**

Troubleshooting
Problem, Probable Cause, Things to Try ..... **Page 9**

TABLES, DIAGRAMS & CHARTS

Features .....**Page 1**

Specifications ..... **Page 3**

Flow Range ..... **Page 3**

Metal Pipe Installation, Plastic Pipe Installation ..... **Page 4**

Straight Pipe Recommendations ..... **Page 5**

Full Pipe Recommendations ..... **Page 6**

High Frequency Output ..... **Page 7**

Display Readings ..... **Page 7**

Connections Diagrams ..... **Page 8**

Troubleshooting ..... **Page 9**

GENERAL INFORMATION

The **FMG-1000 Series** are flanged electromagnetic flowmeters for use in 3" to 10" pipe in municipal or industrial water and wastewater applications where propeller meters have typically been used in the past. Because the FMG-1000 has no moving parts and has electrodes designed to discourage fouling, this magmeter performs well and requires much less frequent maintenance in applications where debris would impede propeller meters. There is no rotor to stop turning or bearings to wear out. Minimal straight pipe requirements allow FMG-1000 Series meters to be used in piping configurations where there is little space between the meter and an elbow.

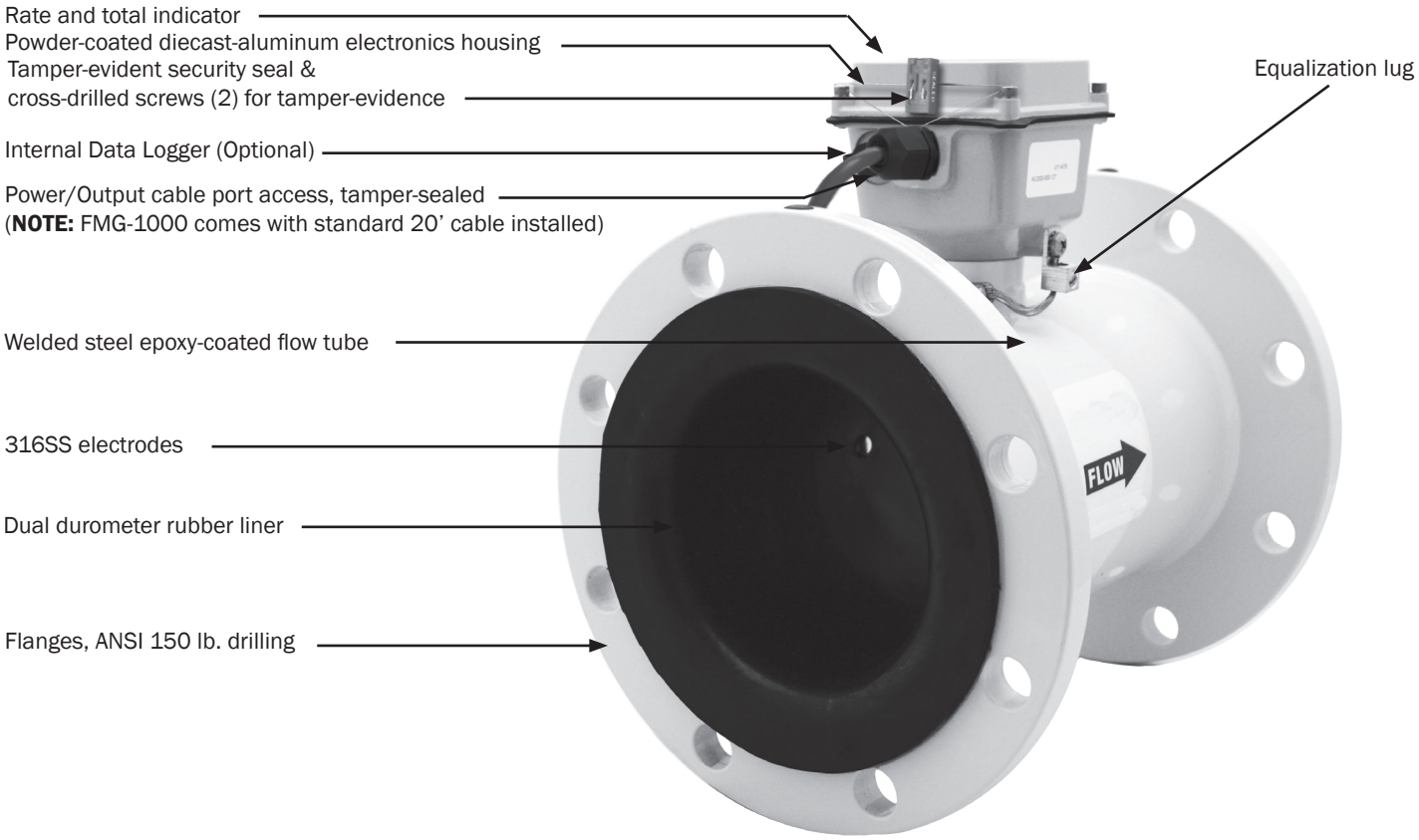
In chemical injection applications, the chemical injection point must be placed downstream of the magmeter OR far enough upstream for **complete mixing** to occur before the fluid reaches the meter.

The submersible units, -SUB option, are rated IP68 (NEMA 6P) for applications where the meter may be under water up to a depth of 3 meters for prolonged periods of time.

Rate and total indication are standard on both models. Units are customer-selected and factory-set. No set-up is required. The **FMG-1000** is externally powered with 8-32 Vdc at 30 mA max (see **NOTE** in Specifications).

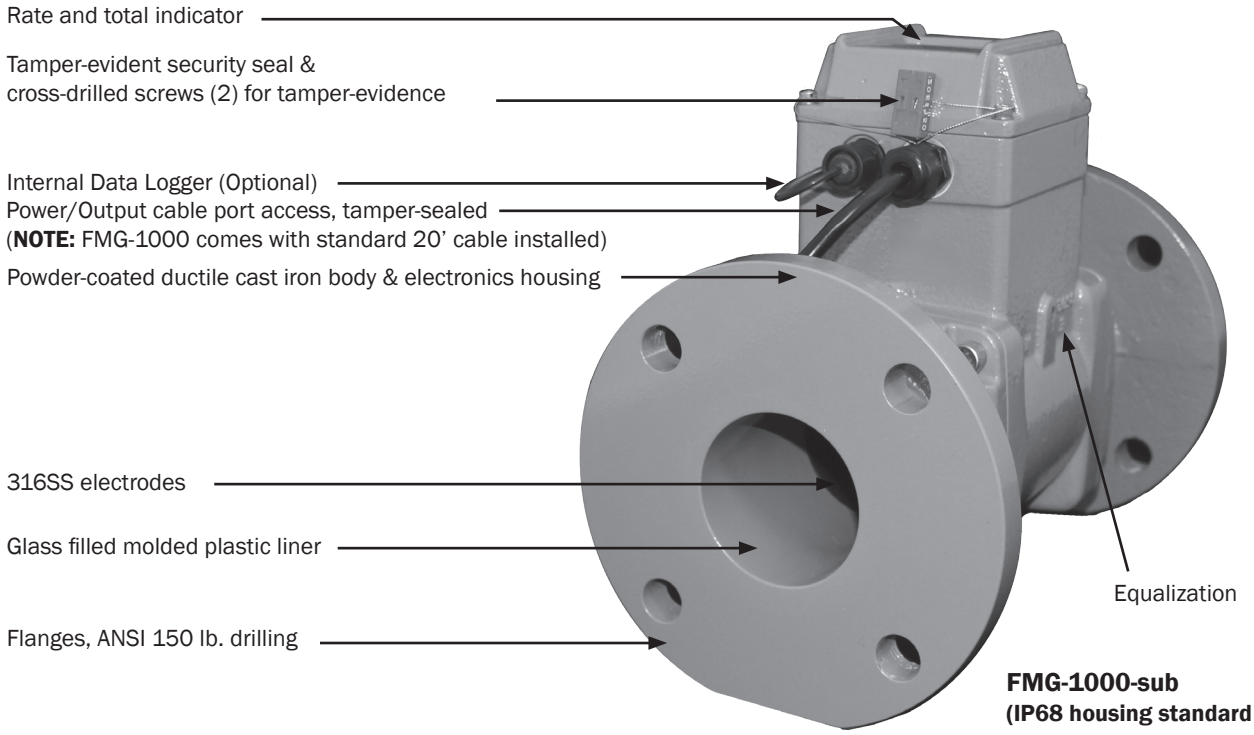
The 20-foot power cable also provides pulse output for use with a variety of displays and controls for remote reading, data logging, pulse-to-analog conversion, and telemetry applications. High frequency pulse rate (required for use with 4-20 mA converters) is standard; additional pulse rates are available.

FEATURES

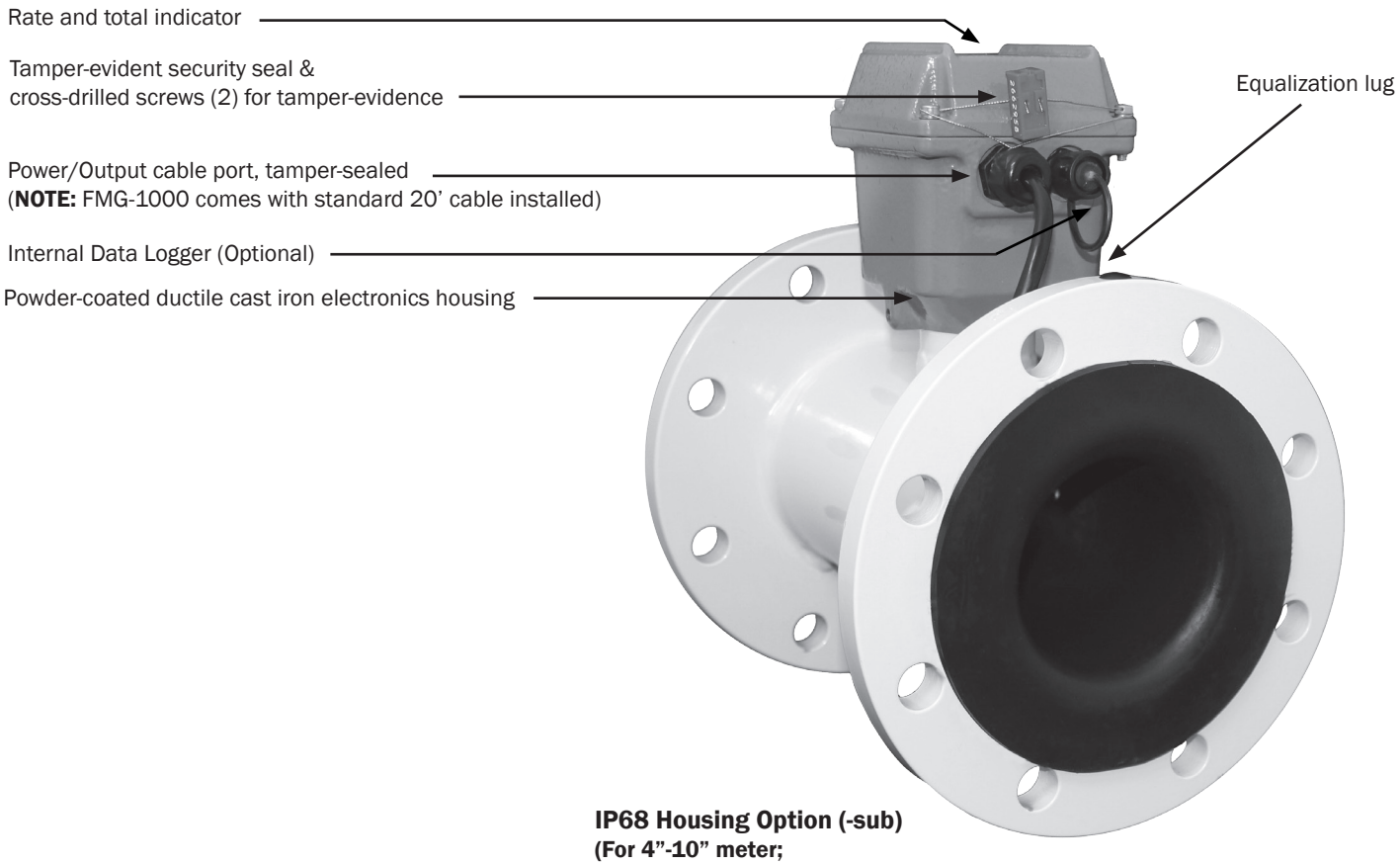


FMG-1000 (Non-IP68)

FEATURES Continued



FMG-1000-sub
(IP68 housing standard for 3" model)



IP68 Housing Option (-sub)
(For 4"-10" meter;
standard for 3" model)

SPECIFICATIONS*

Pipe Sizes		3",4", 6", 8", 10"					
Fittings		ANSI 150 lb. drilling					
Pressure		150 psi (10.3 bar) working pressure					
Temperature	**Operating**	10˚ to 130˚ F (-12˚ to 54˚ C)					
	Non-Operating	-40˚ to 158˚ F (-40˚ to 60˚ C)					
Accuracy		+/- 1% of reading for flow between 10% to 100% of max flow					
		+/- 2% of reading for flow from cutoff to 10% of max flow					
Materials	**Body (3" Only)**	Ductile cast iron, powder coated w/NSF61 listed epoxy powder					
	Body (4"-10")	Welded steel, epoxy-coated					
	Liner (3" Only)	PPO/PPS Blend					
	Liner (4"-10")	Dual durometer rubber					
	Electronics Housing	Diecast aluminum, powder-coated (non-IP68)				Ductile Cast Iron (IP68)	
	Electrodes	316 stainless steel					
	O-ring (3" Only)	EPDM					
Display		**Rate**				**Total**	
	Digits	5				8	
	Units	Gallon/Minute, Liter/Minute, Liter/Second, Cubic Feet/Minute, Cubic Meter/Hour, Million Gallon/Day, Mega Liter/Day				Gallon, Gallon x 1000, Liter, Liter x 1000, Mega Liter, Cubic Meters, Cubic Meter x 1000, Cubic Feet, Cubic Feet x 1000	
Power		8-32 Vdc at 30 mA max NOTE: Using an unregulated power supply >18 Vdc may damage the meter due to AC line input voltage fluctuation					
Pulse Output	**Signal**	Current sinking pulse, opto-isolated, 30 Vdc at 10 mA max					
	Pulse Rates	High Frequency (default); 10 units/pulse; 100 units/pulse; 1000 units/pulse					
	High Frequency (pulse/gal)	**3"**	**4"**	**6"**	**8"**	**10"**	
		25.228	16.362	6.307	3.344	2.150	
Conductivity		>20 microSiemens/cm					
Empty Pipe Detection		Hardware/software, conductivity-based					
Environmental		NEMA 4X Standard (IP68/NEMA 6P Option)					

**Specifications subject to change.*

FLOW RANGE (3" - 10")

Meter Size	3"		4"		6"		8"		10"	
	Gal/Min	Liter/Sec	Gal/Min	Liter/Sec	Gal/Min	Liter/Sec	Gal/Min	Liter/Sec	Gal/Min	Liter/Sec
Minimum	7.5	.47	12	.75	32	2	60	3.8	95	6
Maximum	700	44.2	1,000	63	2,400	151.4	4,400	277.6	7,000	441.6

INSTALLATION

Caution: These flow sensors are not recommended where installation fault may expose the flow sensor to boiler pressure and temperature. Maximum recommended temperature is 130˚ F.

Positioning the Meter. These meters can be installed horizontally, vertically, and in any radial position. **Using a check valve on the upstream side of the meter, and/or an air vent (vacuum relief valve) in the same unobstructed run of pipe as the meter, is required any time reverse suction is present. Reverse suction can cause damage to the liner. Liner damage caused by reverse suction, without the use of a check valve and/or air vent, may void the warranty.**

Straight Pipe Recommendations. As with most flow meters, the FMG-1000 requires some straight pipe before and after the meter for best accuracy. However, the ability of electromagnetic meters to average the flow across the entire pipe allows for shorter straight pipe recommendations than most mechanical meters (see page 4).

Full Pipe Recommendations. All magmeters require a method for determining that the pipe is empty, to prevent false reading. This meter is designed to go to zero reading if one or more electrodes is exposed. For highest accuracy, install the meter so that the pipe will be full when there is flow. If air bubbles may be present in the pipe or sludge accumulation is an issue, rotate the meter by one flange hole to position the control housing at a 45˚ angle (see diagrams on page 5).

Fittings. The flanges have standard ANSI 150 lb. drilling and mate with any other ANSI 150 lb. flange.

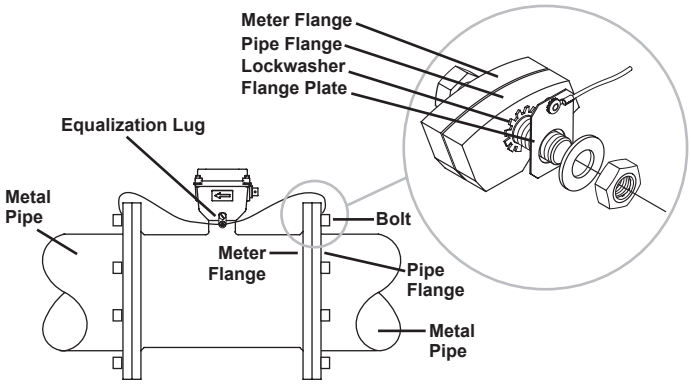
Calibration. The FMG-1000 is factory-calibrated and will not require any form of field calibration.

Chemical Injection. When any magmeter, by any manufacturer, is used in a chemical injection application, **the chemical injection point must be placed downstream of the magmeter OR far enough upstream for complete mixing to occur before the fluid reaches the meter**. When unmixed chemical alternates with water passing through the meter, the rapid changes in conductivity may cause sudden spikes and drops in the meter's reading, resulting in inaccurate measurement. The magmeter will restabilize, however, with a steady flow of fluid of uniform conductivity.

Caution: In chemical injection applications, install chemical injection point downstream of magmeter, or far enough upstream to allow complete mixing of fluids before the meter.

EQUALIZATION AND GROUNDING

Metal Pipe Installations. To equalize the electrical potential of the fluid, the FMG-1000 meter, and the surrounding pipe, secure the flange plates (factory-installed on the equalization lug) to both pipe flanges at one of the bolt holes, as shown below. Be sure the lockwasher fits between the pipe flange and the flange plate.

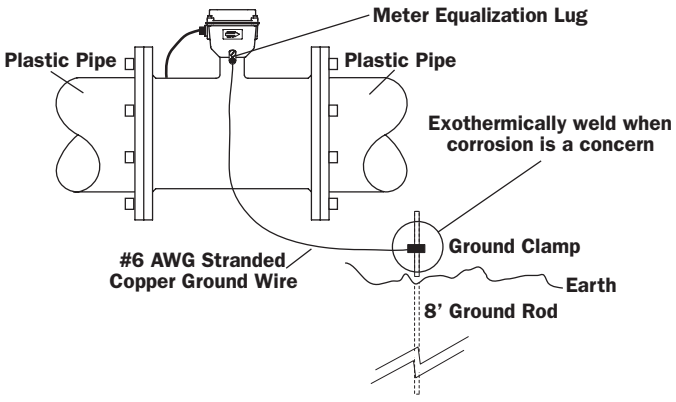


Equalization Diagram

Run wire from equalization lug to both pipe flanges; secure flange plates under bolt heads as shown.

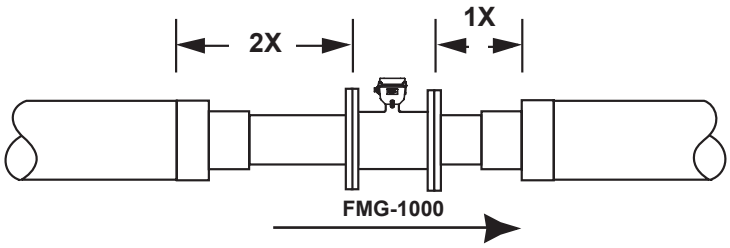
WARNING: ELECTRICAL SHOCK HAZARD When the meter is externally AC powered, the piping system must be grounded to meet national and local electrical safety codes. Failure to do so can result in electrocution.

Plastic Pipe Installations. When the FMG-1000 is installed in a plastic piping system, it is not necessary to use the equalization straps, but very important to ground the meter to avoid electrical shock hazard and electrostatic interference with meter function.

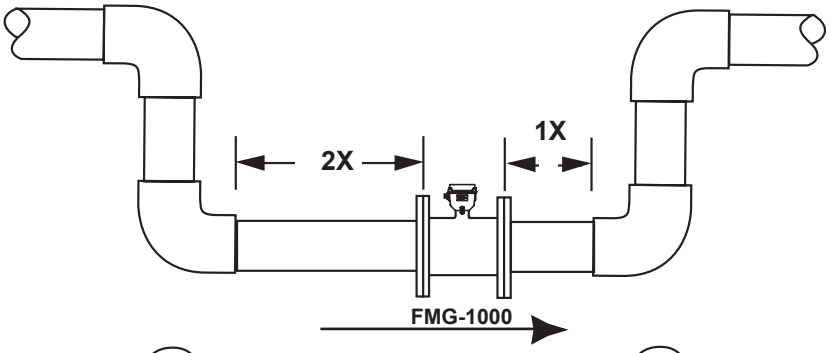


(X = diameter)

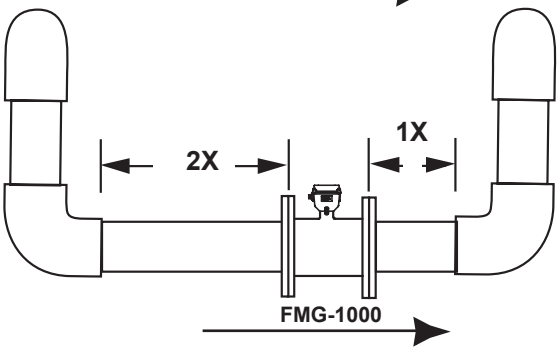
Reduced Pipe



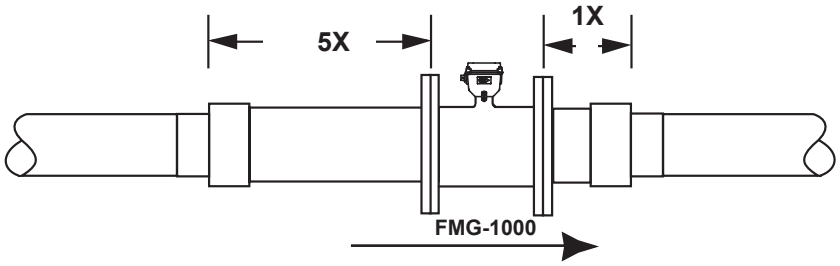
Two Elbows In Plane



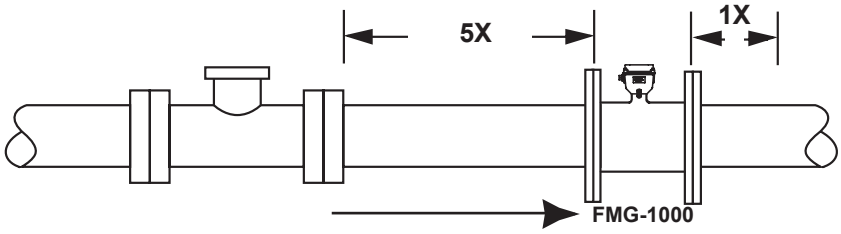
Two Elbows, Out Of Plane



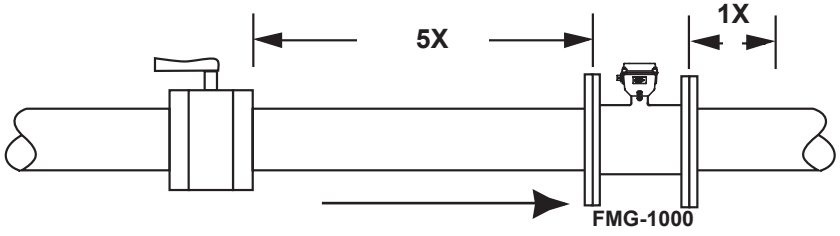
Expanded Pipe



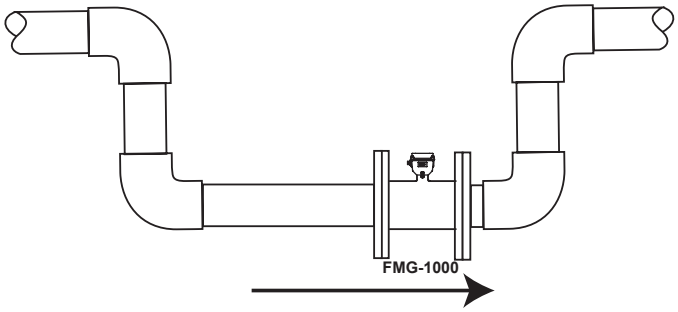
Swirling Flow
Propeller Meter

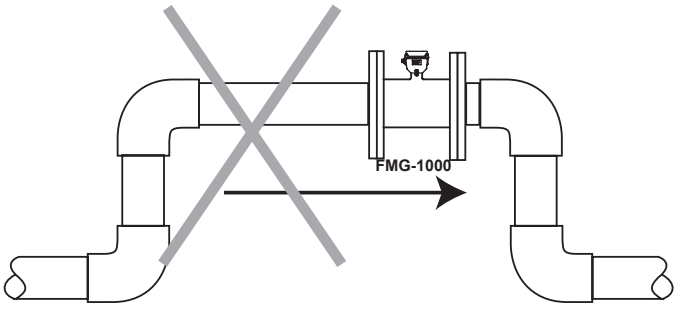


Swirling Flow
Partially Open
Butterfly Valve

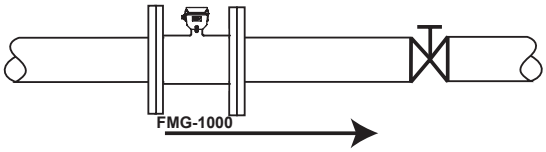


Recommended:
Keep pipe full at meter for accuracy

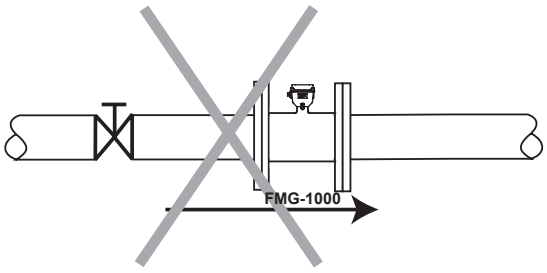




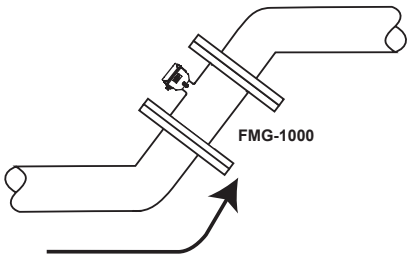
Not Ideal:
Allows air pockets to form at meter



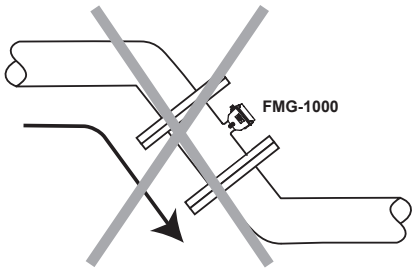
Recommended:
Keeps pipe full at meter for accuracy



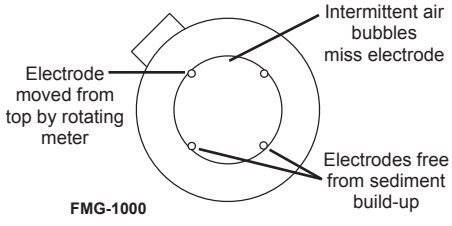
Not Ideal:
Post-valve cavitation can create air pocket



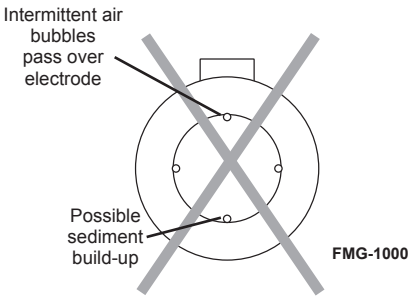
Recommended:
Allows air to bleed off



Not Ideal:
Air can be trapped



Recommended:
Improved accuracy results from unimpeded electrodes



Not Ideal:
Air bubbles and sediment on the electrodes can affect accuracy

INPUTS/OUTPUTS

Power. The FMG-1000 operates on 7-26 Vdc at 30 mA max external power (see WARNING in wiring diagrams). The display reads "P" when external power is in use (see illustration below).

Pulse Output. The cable also provides pulse output that can be used for remote reading, 4-20 mA signal conversion, datalogging, and telemetry applications. See page 7 for connection diagrams to Omega controls and displays.

Pulse rates are selected by the customer at time of order, factory-set, and can only be changed in the field by an authorized Omega dealer. Three pulse rates are possible: One pulse per ten gallons (or liters), one pulse per thousand gallons (or liters), or High Frequency (required for use with 4-20 mA converters; see below):

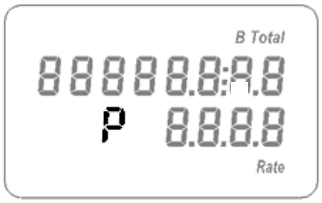
High Frequency Output/K-Factor		
Meter Size	Pulses per Gallon	Pulses per Liter
3"		
4"	16.362	4.323
6"	6.307	1.666
8"	3.344	0.883
10"	2.150	0.568

OPERATION

Caution: There are no user-adjustable connections or settings inside the display housing. Use caution when opening the housing for a battery change, to avoid damage to internal components.

Display Reading. The FMG-1000 display has two lines, the bottom line for flow rate and the top line for accumulated total. Measurement units are pre-ordered and factory-set and can be changed in the field only by an authorized individual.

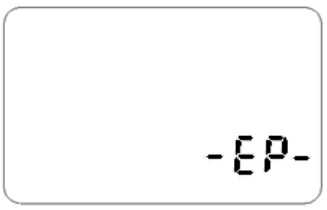
Refer to the diagrams below to read your display.



External Power Indicator

No Power

Meter Installed Backwards



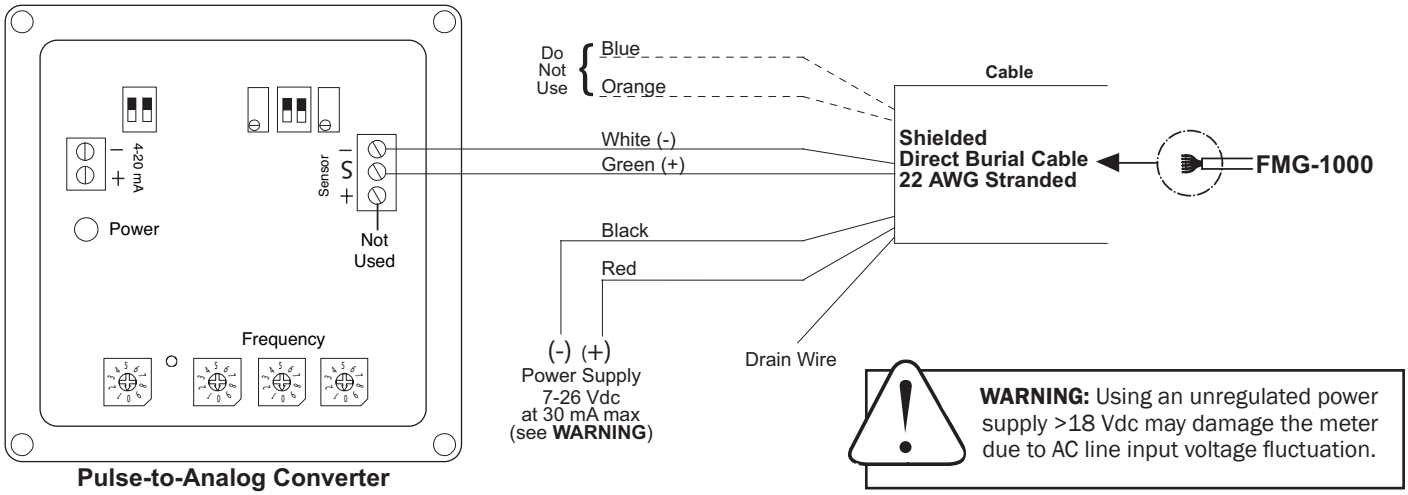
Empty Pipe

The **FMG-1000** requires a power source of 7 to 26 Vdc at 30 mA max (see **WARNING**). The power cable also serves as a pulse output if needed for remote reading, data logging, signal conversion, or telemetry.

FMG1000 Cable Color Codes

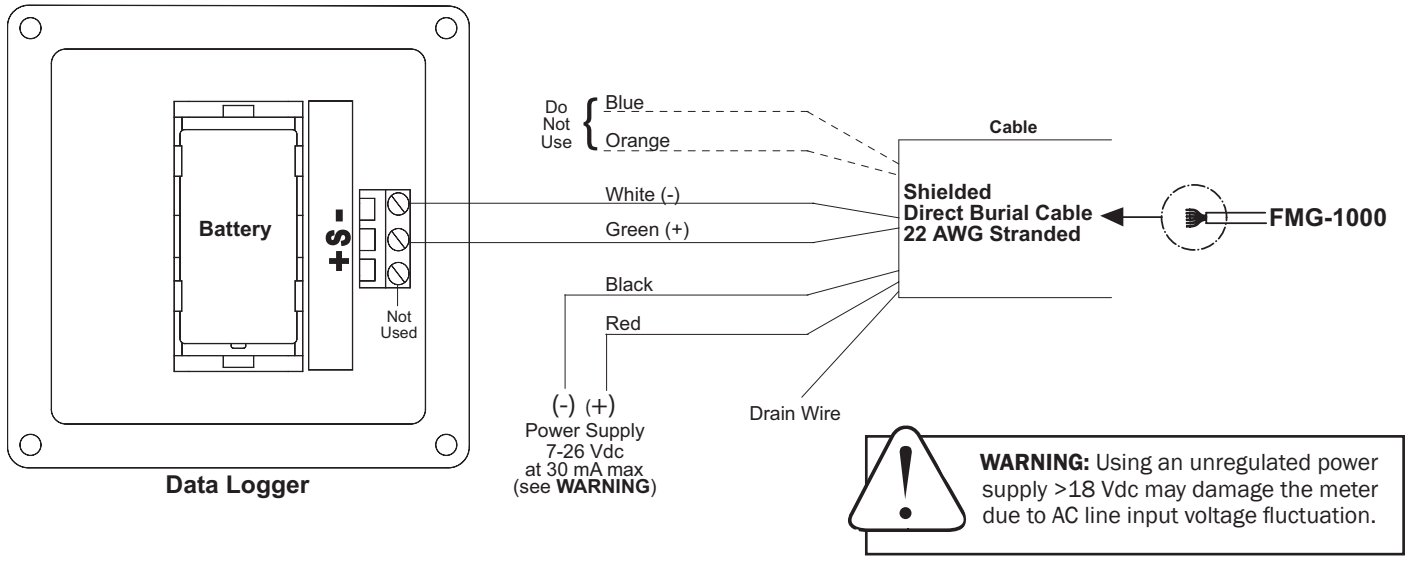
Orange and Blue: Serial Output (Do Not Use)
Green (+) and White (-): Isolated solid-state contact closure pulse output, 30 Vdc max, 10 mA max
Red (+) and Black (-): External Power, 7-26 Vdc at 30 mA max
Drain: Connect to earth ground (see **WARNING**)

FMG-1000-MAW



Pulse-to-Analog Converter

FMG-1000-DL



Data Logger

TROUBLESHOOTING

Problem	Probable Cause	Try...
Blank Display	No power	Check power connections
Flow rate steadily reads zero when there is flow	Flow is below cutoff (very low)	Reading will resume when flow increases
	Pipe not full	Reposition meter for full pipe (see page 4)
	Meter is installed backwards (display reads [-])	Note flow direction arrow, reverse meter
	Power connections reversed	Change power connections
	Fluid conductivity <20mSiemens/cm	Select another flow meter
Flow rate intermittently drops when there is flow	Pipe not full	Reposition meter for full pipe (see page 4)
Jumpy reading	Missing or incorrect ground wire	Check for proper ground
	Rapidly changing conductivity (in chemical injection applications)	Install chemical injection line downstream of meter (or far enough upstream to allow complete mixing of fluids before meter)
Meter reads, but no pulse output	External device needs pull-up resistor	Add pull-up resistor
	Reversed leads (polarity sensitive)	Change output connections
Output pulses missing	Meter not reading	Check display

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- Wire: Thermocouple, RTD & Thermistor
- Calibrators & Ice Point References
- Recorders, Controllers & Process Monitors
- Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- Transducers & Strain Gages
- Load Cells & Pressure Gages
- Displacement Transducers
- Instrumentation & Accessories

FLOW/LEVEL

- Rotameters, Gas Mass Flowmeters & Flow Computers
- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

pH/CONDUCTIVITY

- pH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

DATA ACQUISITION

- Data Acquisition & Engineering Software
- Communications-Based Acquisition Systems
- Plug-in Cards for Apple, IBM & Compatibles
- Datalogging Systems
- Recorders, Printers & Plotters

HEATERS

- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments